WATER QUALITY AND HYDROLOGY
OF THE BEAVER RIVER
GREY COUNTY

Water Resources Assessment Unit
Technical Support
Southwestern Region

Field Work 1981-82
Report 1983

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1.0 SUMMARY, DISCUSSION AND CONCLUSIONS

The Beaver River is a high quality water resource. The river has good base flows and much of the system is characterized by cool, clear flowing streams which provide excellent habitat for cold water fish species.

Levels of the critical nutrient phosphorus are at or near the recommended MOE objective of .03 mg/L. Phosphorus levels above this objective will promote luxuriant growths of aquatic plants, especially the nuisance filamentous green algae Cladophora which is now present in the Beaver River.

Fortunately, the Beaver River is unique in that the main stream is forested throughout most of its length. This forested zone helps promote lower water temperatures, limits nutrient inputs, discourages aquatic plant growths and provides food and a suitable habitat for the diverse aquatic insect communities.

Serious water use and water quality problems now exist on the Avon River, the Bayfield River and the Maitland River in Southwestern Ontario as a result of luxuriant Cladophora growths. Special efforts will have to be taken to protect the Beaver River, as it is very susceptible to Cladophora growth because of the predominance of clear flowing waters and rocky substrate suited to the excessive development of this troublesome algae.

Efforts should be taken to improve the existing water quality in the Beaver River. The somewhat elevated phosphorus levels are no doubt the result of poor livestock management practices. Cattle have direct access to the water in many areas, allowing stream bank erosion to occur. This results in turbid water conditions and high bacteria

and phosphorus inputs. Cattle also tend to trample or remove streambank cover which would otherwise help to shade and cool the stream.

In the future, the water quality and quantity of the Beaver River will depend on:

1. The use of basic conservation practices within the watershed such as:

   (a) maintenance and protection of existing forested zones along the river.
   (b) preservation of existing wetland areas.
   (c) maintainance of natural buffer strips between farmyards and watercourses.
   (d) controlled cattle access to watercourses.
   (e) erosion control techniques applied throughout the basin.

2. Animal waste management and pasturing practices. Proper manure handling and animal confinement practices should be implemented to reduce nutrient and sediment inputs to the river.

3. The manner in which pond and dam construction occurs within the basin. Many cool and cold water streams are being subjected to erratic flow and temperature changes in, and downstream of, these structures.

4. The degree and nature of construction of agricultural and urban drainage systems in the basin. These actvities can have major effects on water quantity and quality. Altered drainage systems, especially if not properly designed and maintained, may have the ability to deliver shock loads of nutrient-rich, turbid warm water to the system. Many of the aquatic organisms and fish found in the Beaver River are very sensitive (intolerant) to high turbidity and high water temperatures.

RECOMMENDATIONS

1. Livestock operators in the Beaver River Basin should review and upgrade their waste handling and pasturing procedures where necessary. Direct runoff from feedlots or areas of manure spreading adjacent to streams are not acceptable. Livestock should also be kept out of watercourses. Use of grants available under the Ministry of Agriculture and Food's Soil Conservation and Environmental Protection Assistance Program will help to defray the costs of necessary improvements.

2. The Ministry of Natural Resources and the North Grey Region Conservation Authority should promote stream fencing and forested buffer zones, especially in livestock areas within the watershed.

3. Urban and agricultural drainage schemes in the basin must consider the use of the natural stream system, with the goal of retention of the pre-construction runoff hydrograph. The quality of the runoff water should not affect the thermal regime of the stream or increase suspended solid levels.

4. The construction of ponds and dams within the basin should be carefully assessed. These structures should be engineered in such a manner that the thermal regime of the stream is not altered and that stream flows remain normal at all times.

5. The operation and construction of municipal, industrial, commercial and private sewage systems in the basin will have to be carefully reviewed on a site specific basis. Discharges of effluents high in nutrients, suspended solids or other contaminants could seriously degrade existing water quality.

6. The Ministry of the Environment should continue to identify sources of contamination within the basin and promote the necessary corrective actions in co-operation with other land management agencies.

7. Existing and proposed aquaculture farms (fish hatcheries, bait holding facilities) should operate according to the Provincial Water Quality Objectives.

8. All Government agencies involved in planning processes should work with municipal planners, who in turn should ensure that proper development standards are utilized in planning instruments to protect water quality and quantity.

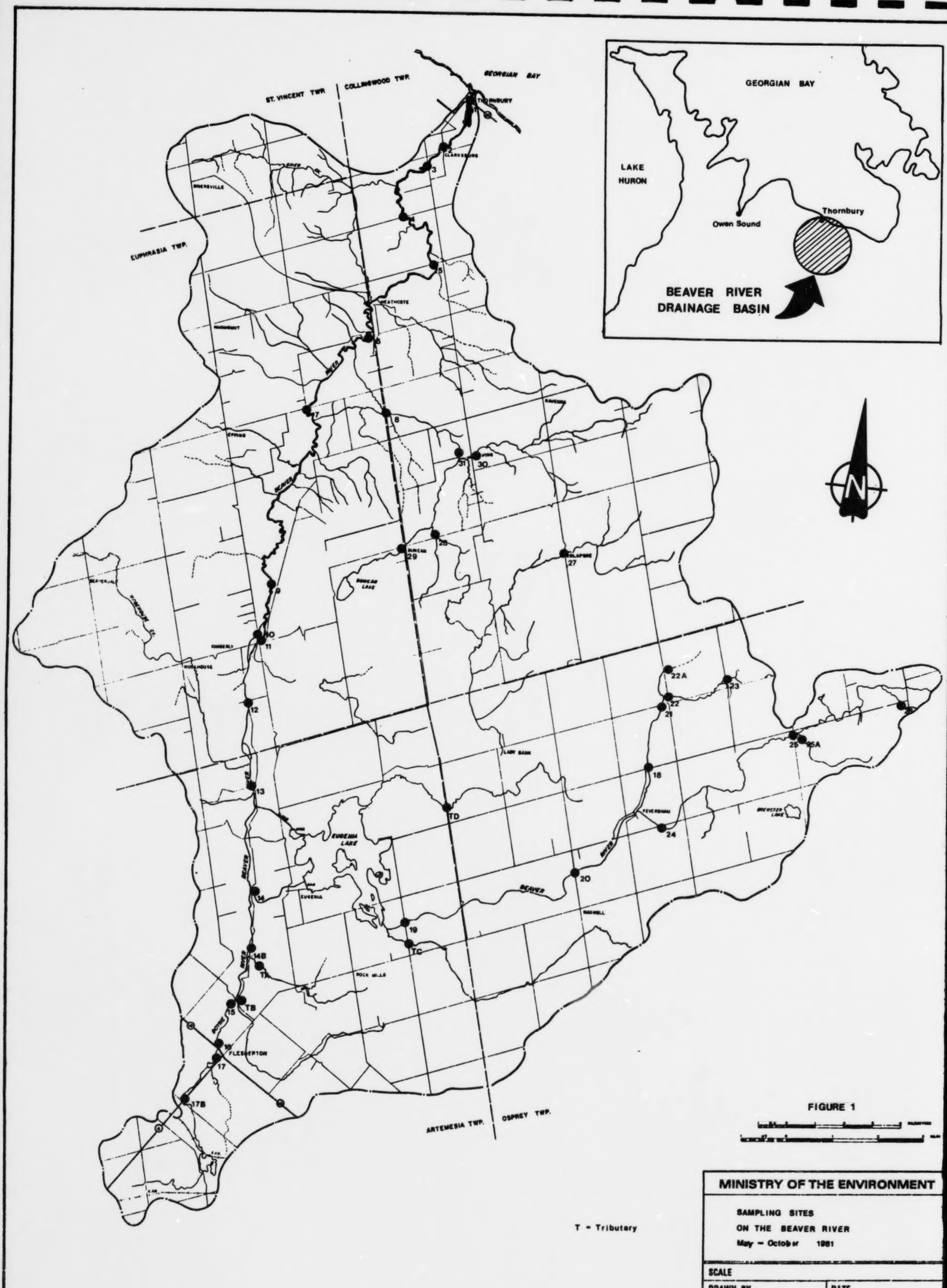
2.0 INTRODUCTION

The Beaver River flows into Georgian Bay at Thornbury (see Figure 1), draining an area of 572 km. The Beaver River basin has numerous small rural centres such as Heathcote, Kimberly, Clarksburg, Ravenna, Redwing Fairmont, Feversham, Maxwell and Epping. Two larger centres are also located within the basin. The Town of Thornbury is located at the River mouth (1980 population 1427) and the Village of Flesherton (1980 population 576) is located near the head of the Beaver Valley.

The major land uses in the basin are agriculture and recreation. Apple production is a major industry in the Beaver Valley where approximately 25% of Ontario's apples are produced. Considerable areas of the Beaver River Basin are used for livestock production (cattle, hogs).

The Beaver Valley provides numerous recreational opportunities. The major recreational resource is downhill skiing, while cross-country skiing is also very popular. Two major ski resorts are located within the Beaver Valley. Fishing is very popular throughout the watershed. Rainbow trout runs occur at Thornbury in spring and fall attracting hundreds of anglers. Snowmobiling, boating, hiking and sightseeing also draw many tourists to the area.

The physiography of the watershed is described by Chapman and Putnam (1967) who define the Beaver Valley as one of the most scenic features of Southern Ontario. The valley floor is basically a clay plain, although silt and fine sandy lenses and till soils are present near Thornbury. The valley slopes are steep and are composed of reddish shale soils. The top of the valley both east and west is comprised of extensive escarpment and cliffs. Limestone



T = Tributary

FIGURE 1

MINISTRY OF THE ENVIRONMENT	
SAMPLING SITES ON THE BEAVER RIVER May – October 1981	
SCALE	
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plains cover a large area on the easterly portion of the watershed.

The watershed gradient averages 5.1 meters/kilometer (26.9 feet/mile). A 333-meter (1094-foot) elevation difference exists from the headwaters of the Beaver River to Georgian Bay. Stream gradients are generally quite gradual. However, a number of tributaries have steep gradients as they flow directly down the sides of the valleys.

Numerous on-stream ponds and dams (approximately 20) are present in the watershed. Large ponds are located near Flesherton, Feversham, Clarksburg and Thornbury. The ponds and dams are used for various purposes including flood control, recreation and the generation of electrical power.

Four lakes are present within the basin - Lake Eugenia, Wilcox Lake, Duncan Lake and Brewster Lake. Lake Eugenia (owned by Ontario Hydro) is the largest (about 709 hectares - 1419 acres) and is used for hydro production, cottaging, swimming, fishing and boating. Water from the lake flows over the rim of the valley creating a picturesque waterfall at Eugenia. Wilcox Lake is small (27.60 ha - 68.53 acres) and has a number of private cottages. Ducan and Brewster Lakes are very small private lakes.

Water quality conditions for Eugenia and Wilcox Lakes are presented in The Ontario Ministry of the Environment Report "Water Quality Summary for the Inland Lakes of Grey and Bruce Counties" (published January 1983).

3.0 METHODS

3.1 Hydrology

Streamflow data near the mouth of the Beaver River, as recorded by Federal Streamflow Gauge No. 02FB009, was reviewed for the period of record. Also, streamflow was measured 3 times at 18 locations on the watershed during the study. Efforts were made to obtain flows throughout the watershed during the period of low summer flow (see Table 3).

3.2 Water Temperatures

During a warm weather low-flow period in August 1981, maximum and minimum thermometers were placed in the stream at 20 locations. Each thermometer was left at a particular measuring site for at least 72 hours. It is believed that the survey results reflected the temperatures that were maximum for the summer since the weather during this period was warm and sunny.

3.3 Chemical and Bacterial Data

Water samples were collected at 38 locations in the watershed between May and October, 1981. Samples for chemical analysis were collected at least five times at most sites, while bacterial samples were collected three times at most sites. In addition, water quality data from six long-term monitoring stations (Nos. 03-0036-002-02, 03-0036-005-02, 03-0036-006-02, 03-0036-007-02, 03-0036-008-02, 03-0036-009-02) located throughout the basin were reviewed (see Appendix II).

3.4 Bottom Fauna

Collections of bottom fauna (aquatic insects and other animal life) were made at 37 stations during August 1981. Quantitative sampling using a Surber sampler, plus two qualitative samples with a hand sieve were carried out at most sites (see Appendix I).

3.5 Aquatic Vegetation

During the study period May - October, 1981 general observations were made as to the extent of aquatic plant growth in the Beaver River.

4.0 DISCUSSION OF RESULTS

4.1 Hydrology

Table 1 illustrates the hydrology during 1981 for gauging site No. 02FB009, located at Clarksburg near the mouth of the Beaver River.

The data (Tables 1 and 2) reveal good base flow conditions. Typical low summer flows at the gauging station are 1.4 to 3.0 cms with a mean flow of 3.6 and 4.0 cms for July and August, the two lowest months.

Table 3 tabulates the flow data obtained during the survey at 18 selected streamflow sites.

The hydrology information documents good baseflow conditions generally throughout the basin. However, low-flow to no-flow conditions were observed on Grier Creek and on a tributary stream which joins the Beaver River at Heathcote, draining the area to the east. These conditions were observed during mid-July to August 1981.

Table 1. Daily discharge in cubic metres per second for Beaver River near Clarksburg, 1981, Station No. 02FB009.

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	5.80B	6.50B	22.2	19.6	7.79	6.68	3.39	1.57	13.0	5.63	7.55	12.3	1
2	5.79B	7.10B	19.4	18.1	7.42	6.29	3.30	1.43	12.9	6.66	7.36	13.0	2
3	5.78B	6.70B	15.6 B	17.0	7.09	6.12	3.23	1.52	11.3	7.80	7.12	11.9	3
4	5.77B	6.55B	15.0 B	16.3	6.84	6.87	3.84	1.60	13.5	7.50	6.93	11.0	4
5	5.75B	6.45B	14.9	15.4	6.57	6.55	6.73	1.77	13.2	7.14	6.68	10.5	5
6	5.73B	6.40B	13.8 B	14.1	6.51	6.17	7.22	2.64	13.0	11.6	6.74	9.96	6
7	5.71B	6.35B	13.5	13.1	6.44	5.82	6.60	2.94	12.2	15.4	7.07	9.50	7
8	5.68B	5.80B	13.2	12.2	6.19	5.56	5.98	3.23	11.3	14.2	7.34	9.53	8
9	5.65B	5.40B	13.0	12.4	5.94	5.72	5.42	3.65	12.2	13.0	7.44	8.36	9
10	5.61B	4.84B	12.7	11.9	7.46	6.26	4.99	2.42	10.5	11.7	7.26	5.81B	10
11	5.60B	6.11B	12.2	11.4	22.7	7.09	4.71	3.02	9.20	10.6	7.13	6.29	11
12	5.59B	8.46B	11.4	11.0	22.1	6.84	4.59	3.32	8.25E	9.72	7.01	7.75	12
13	5.58B	9.20B	10.8	10.4	18.8	6.48	4.46	3.23	7.55	9.05	6.83	8.77	13
14	5.57B	8.80B	9.90B	11.1	16.1	6.17	4.33	3.15	6.89	8.33	6.65	9.36	14
15	5.55B	8.40B	10.2	11.1	14.6	5.90	3.40	5.27	6.34	7.82	6.51	9.38	15
16	5.55B	9.90B	9.20B	10.7	14.1	5.82	2.82	5.88	5.93	7.51	8.83	8.12	16
17	5.57B	30.8	8.60B	10.2	12.5	5.92	2.68	5.38	5.65	7.07	12.7	6.84B	17
18	5.58B	47.8	8.40B	10.5	11.3	5.64	2.61	4.78	5.59	8.56	11.1	4.82B	18
19	5.59B	56.9 B	8.60B	10.6	10.2	4.29	2.63	3.45	5.47	9.92	10.1	5.40B	19
20	5.60B	46.1 B	8.70B	10.3	9.30	3.55	2.64	3.59	5.41	9.06	10.3	5.18B	20
21	5.80B	40.1	8.90B	9.91	8.58	3.39	2.61	2.22	5.40	8.45	12.6	6.47	21
22	5.95B	36.0	9.01	9.30	7.98	4.43	2.53	2.34	5.42	8.51	11.6	7.72	22
23	6.23B	42.1	10.5	8.97	7.45	6.51	2.47	2.51	5.40	9.41	10.8	8.16	23
24	6.50B	41.1	11.1	8.80	7.08	5.64	2.40	2.65	5.37	9.84	10.0	8.28	24
25	6.70B	36.3	11.5	8.70	6.88	4.62	2.33	2.90	5.23	9.62	9.03	8.36	25

B - Ice Conditions
E - Estimated

Table 1. (continued)

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
26	7.00B	30.0	11.6	8.68	6.75	4.03	2.32	2.86	5.35	9.34	9.55	8.17	26
27	7.40B	25.5	12.3	8.53	6.66	3.74	2.33	2.77	5.88	9.10	28.6	8.00	27
28	7.30B	24.7	12.5	8.38	6.77	3.39	2.39	3.44	6.07	8.76	17.6	7.99	28
29	7.00B		14.0	8.45	6.62	3.31	3.16	8.89	5.96	8.44	15.2	7.88	29
30	6.80B		18.4	8.19	7.24	3.48	2.55	14.7	5.72	8.08	13.5	7.69	30
31	6.60B		20.5		7.10		1.95	13.6		7.80		7.54	31
TOTAL	186.33	570.36	391.61	345.31	299.06	162.28	112.61	122.72	245.18	285.62	297.13	260.03	TOTAL
MEAN	6.01	20.4	12.6	11.5	9.65	5.41	3.63	3.96	8.17	9.21	9.90	8.39	MEAN
MAX	7.40	56.9	22.2	19.6	22.7	7.09	7.22	14.7	13.5	15.4	28.6	13.0	MAX
MIN	5.55	4.84	8.40	8.19	5.94	3.31	1.95	1.43	5.23	5.63	6.51	4.82	MIN

B - Ice Condition
E - Estimated
Note: Drainage Area 572 Km^2

Table 2. Monthly flow data for Beaver River near Clarksburg.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average Monthly Flow	6.61	7.80	13.88	18.66	9.57	5.33	4.32	3.53	4.07	4.75	6.70	8.10
Average Minimum Monthly Flow with a Recurrence Interval of 2 Years	6.23	6.40	12.00	18.80	9.00	5.20	3.95	3.23	3.65	4.25	6.19	7.10
Average Minimum Monthly Flow with a Recurrence Interval of 5 Years	3.94	4.25	8.00	12.20	5.20	3.45	2.79	2.55	2.90	2.90	3.94	4.85
Average Minimum Monthly Flow with a Recurrence Interval of 10 Years	3.22	3.79	6.60	9.80	4.18	2.90	2.39	2.30	2.75	2.40	3.08	3.95
Average Minimum Monthly Flow with a Recurrence Interval of 20 Years	2.75	3.50	6.00	8.40	3.85	2.62	2.10	2.14	2.70	2.10	2.53	3.45

Note: All flows are given in cubic meters per second (cms)
1957-81 period of Record - 572 sq. km drainage area

Table 3. Beaver River Flow Data July-November 1981
Summary of 18 selected streamflow sites

Station	Date	cms	Remarks
Sta TA	July 29	0.28	Boyne River
	Aug 18	0.17	Tributary
	Nov 18	0.29	
Sta TB	July 29	0.16	Boyne River
	Aug 18	0.05	Tributary
	Nov 18	0.36	
Sta TC	July 29	0.21	Little Beaver
	Aug 18	0.14	River Tributary
	Nov 18	0.26	
Sta 8	July 29	1.07	Mitchell Creek
	Aug 18	0.43	
	Nov 18	2.92	
Sta 15	July 29	0.20	Boyne River
	Aug 18	0.10	
	Nov 18	0.36	
Sta 17B	Nov 18	0.15	Boyne River
Sta 18	July 29	0.43	Beaver River
	Aug 18	0.33	
Sta 19	July 29	1.26	Beaver River
	Aug 18	0.99	
	Nov 18	1.87	
Sta 21	Nov 18	0.44	Beaver River
Sta 22	Nov 18	0.30	Beaver River
Sta 24	July 29	0.40	Beaver River
	Aug 18	0.30	Tributary
Sta 25	July 29	0.17	Beaver River
	Aug 18	0.08	Tributary
	Nov 18	0.26	
Sta 25A	July 28	0.06	Beaver River
	Aug 18	0.03	Tributary
	Nov 18	0.09	
Sta 29	July 29	0.03	Mitchell Creek
	Aug 18	0.01	
Sta 30	July 29	0.13	Mitchell Creek
	Aug 18	0.07	
	Nov 18	1.15	
Sta 31	July 29	0.88	Mitchell Creek
	Aug 18	0.32	
	Nov 18	3.28	

4.2 Water Temperatures

Figure 2 illustrates the water temperatures found during a 72-hour temperature study (August 4-6, 1981). In general, only the small tributary streams to the Beaver River could be classed as cold water streams. Many streams have ponds and dams which cause water temperatures to increase. Other streams have been cleaned of streambank cover, trees and bushes. Certain areas of the watershed appear to have substantial beaver populations, as observed in the upper Mitchell Creek, Mill Creek area. The flooding of forested areas and the creation of large shallow wetland zones have drastic effects on the thermal regime of a stream. Temperature readings collected through the study period defined the main river as generally warm in nature during August 1981. This situation existed from Station 13 downstream to Thornbury. Water temperatures, however, were not exceedingly warm throughout this zone (23-25°C) with cooler temperatures occurring in forested areas, such as at Station 12 and Station 7.

4.3 Suspended Solids

Water clarity is generally excellent (less than 5 mg/l suspended solids) throughout the Beaver River watershed. However, Stations 1 to 3 downstream from the Clendenan Dam had elevated levels (10-13 mg/l) of suspended solids. Mitchell's Creek and tributaries (station 8, 28, 29, 31) also had higher levels (10-65 mg/l) of suspended solids than other areas of the watershed. Livestock access to streams was observed to be causing erosion and disturbances of bottom sediments. The steep gradients in this area also create very fast streamflows resulting in streambank erosion.

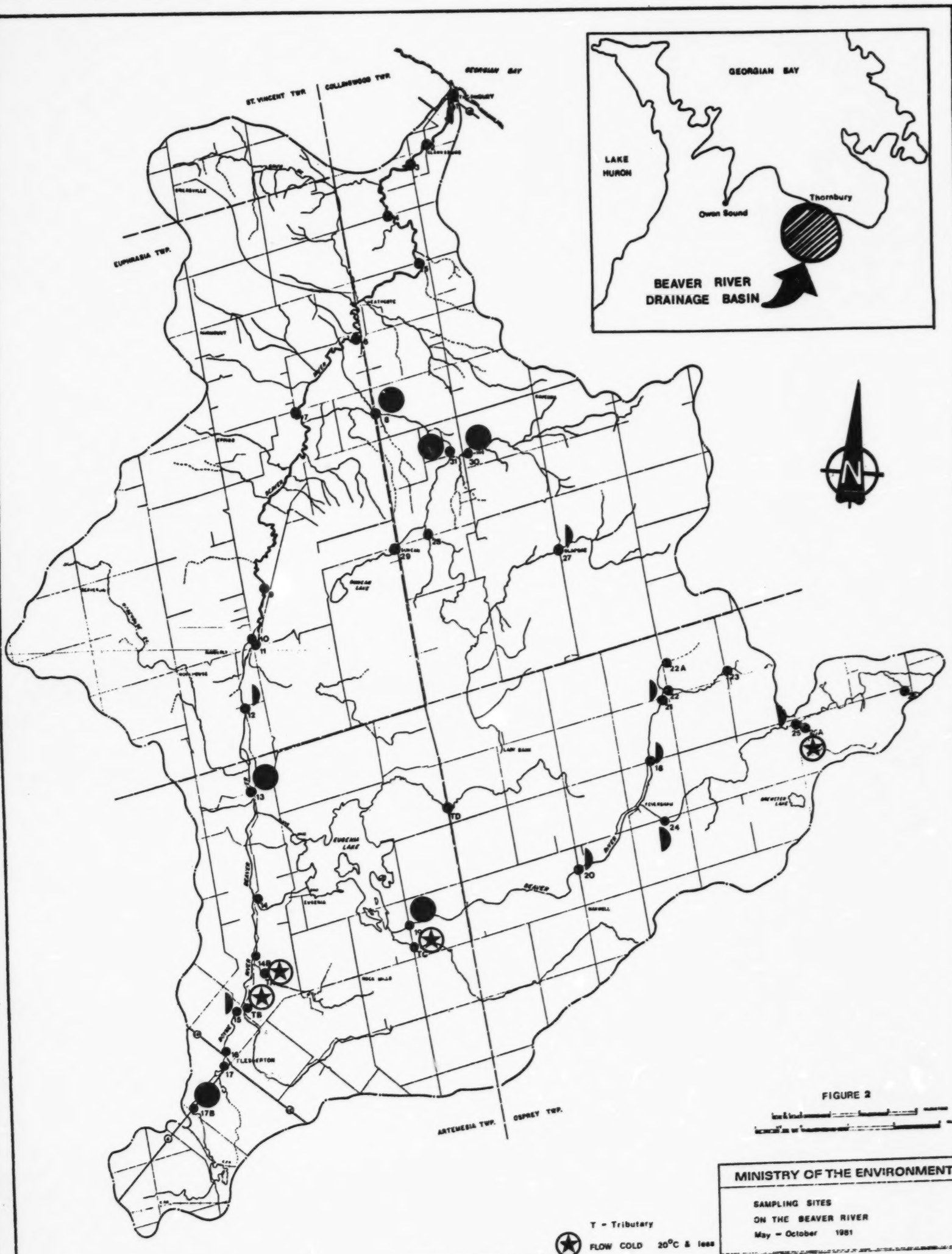


FIGURE 2

MINISTRY OF THE ENVIRONMENT

SAMPLING SITES
ON THE BEAVER RIVER
May – October 1981

SCALE	
DRAWN BY	DATE
CHECKED BY	DRAWING NO.

4.4 Phosphorus

Levels of phosphorus were found to be elevated throughout a considerable part of the Beaver watershed. MOE guidelines state that total phosphorus levels of .03 mg/l or greater can cause nuisance aquatic plant growth. Many areas of the Beaver River (20 stations) are close to or exceed the guidelines. Figure 3 illustrates that the Ministry's objective was exceeded at seven of the 38 sampling locations. Six of these sites occurred on smaller tributary streams in agricultural areas (livestock areas) mainly in the Beaver River upstream from Feversham and in the Mitchell's Creek system. Elevated phosphorus levels (.032 mg/l) were also documented immediately downstream from a commercial fish farming operation. Exceedingly high phosphorus levels (10.86 mg/L) were documented entering the watershed at station 26. This site was located downstream from a large livestock operation. Since the field study, changes have been made at this site to reduce farmyard runoff.

4.5 Nitrate

Levels of nitrate (nitrogen) are favorably low (generally less than 1.0 mg/l) in most of the river. Nitrate levels are illustrated in Figure 4.

4.6 Other Chemical Parameters

No attempt is made in this report to interpret the remaining chemical parameters. However, the data are presented in Appendix II for future reference and comparative purposes.

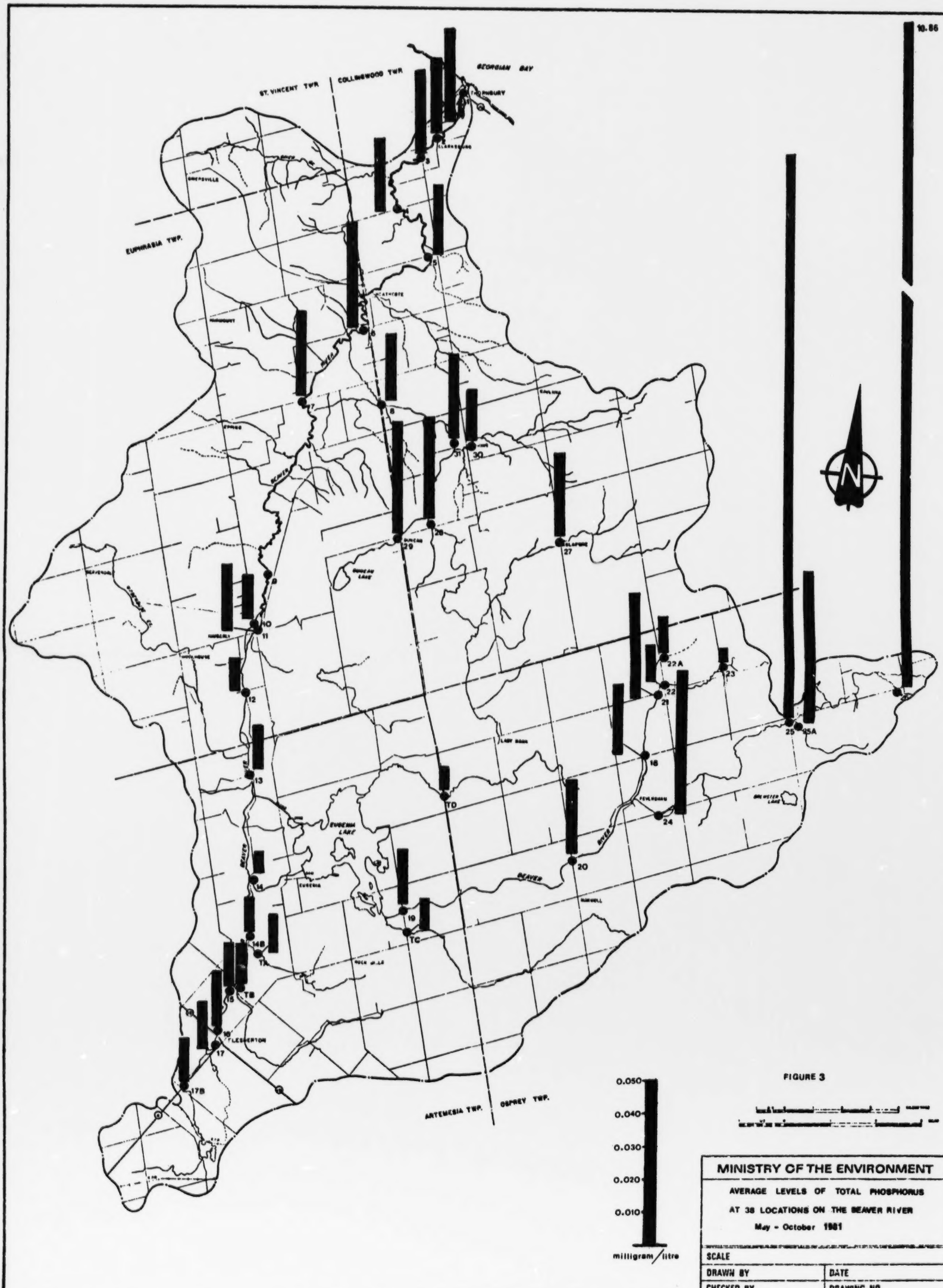


FIGURE 3

MINISTRY OF THE ENVIRONMENT

AVERAGE LEVELS OF TOTAL PHOSPHORUS
AT 38 LOCATIONS ON THE BEAVER RIVER
May - October 1981

SCALE	
DRAWN BY	DATE
CHECKED BY	DRAWING NO.

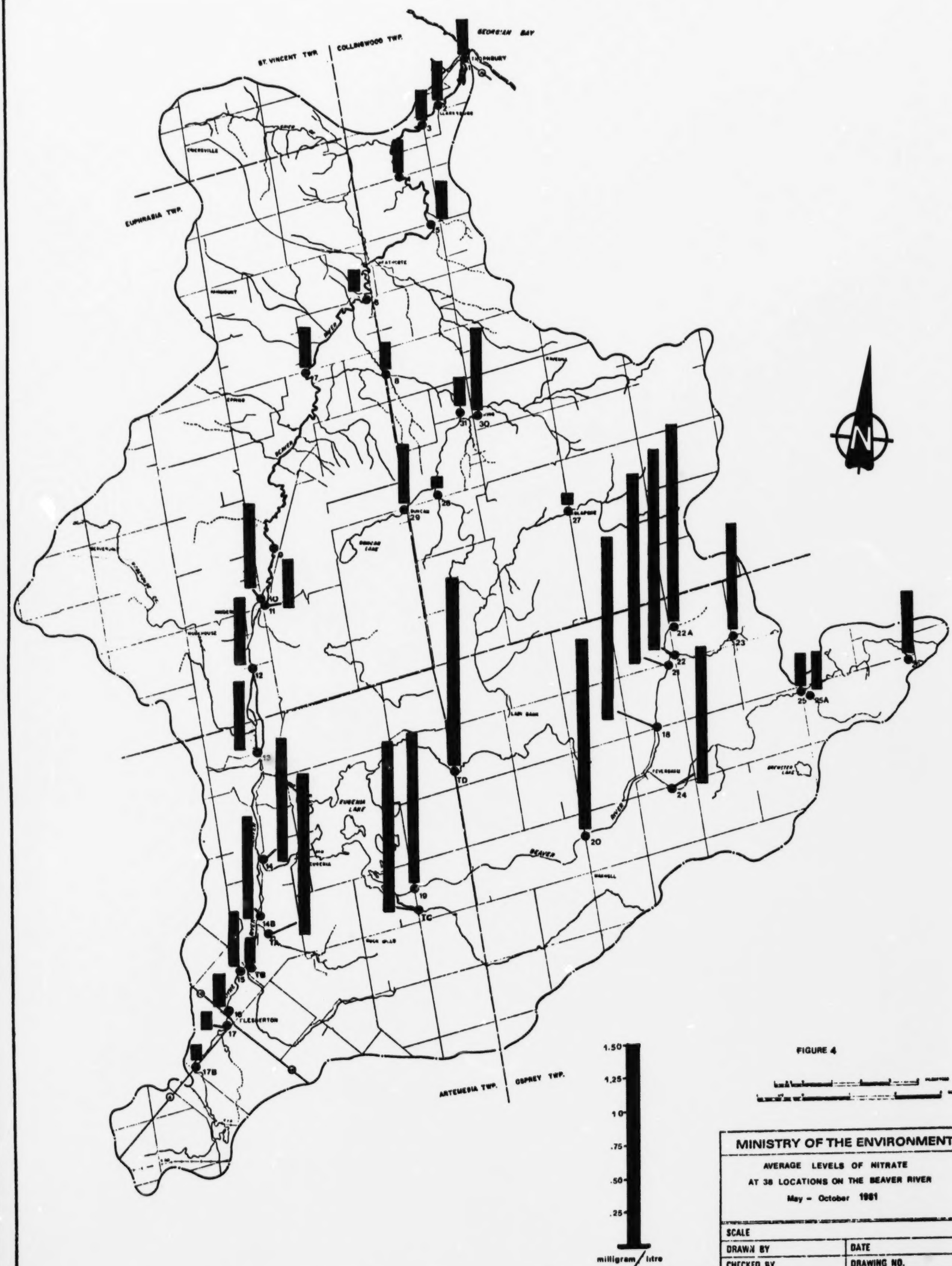


FIGURE 4

MINISTRY OF THE ENVIRONMENT

AVERAGE LEVELS OF NITRATE
AT 38 LOCATIONS ON THE BEAVER RIVER
May - October 1981

SCALE	
DRAWN BY	DATE
CHECKED BY	DRAWING NO.

4.7 Bacteria

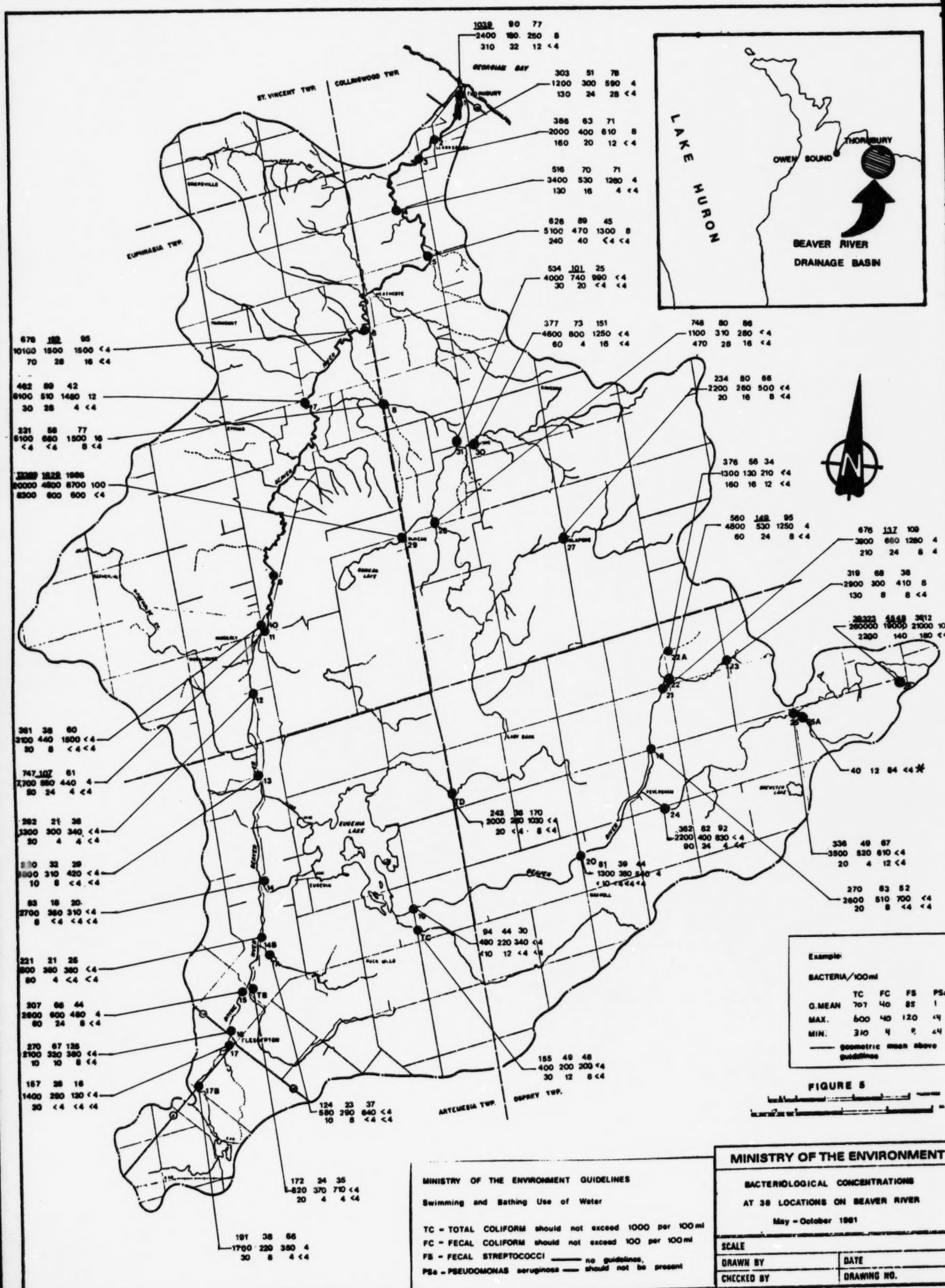
The Ministry of the Environment's guidelines recommend that total coliform bacteria levels should not exceed 1000 per 100 ml of sample, and fecal coliform bacteria levels should not exceed 100 per 100 ml sample. Fecal streptococci, an indicator bacteria associated with animal and human waste, should be found only in low numbers. Pseudomonas aeruginosa, an opportunistic pathogen usually associated with human waste, should preferably not be present in lake and stream water. Results for Pseudomonas aeruginosa are usually reported as less than 4 (<4/100 ml of sample) meaning that the analysis could not provide a specific numeric result but could provide the order of magnitude of the result. The (4) indicates that the actual density was less than 4 in 100 ml of water.

Figure 5 illustrates levels of total coliforms, fecal coliforms, fecal streptococci and Pseudomonas aeruginosa. In general, bacteria levels are satisfactory. However, elevated levels are present in localized areas. These elevated levels are no doubt a reflection of livestock activity. At numerous locations, cattle and other livestock have direct access to streams. Direct farmyard runoff to the water course was observed in some areas.

4.8 Bottom Fauna

The bottom fauna data are presented in Appendix I.

The bottom fauna communities found throughout the Beaver river watershed are generally very diverse and well balanced. Station 15 downstream from Flesherton, Station 24, upstream from Feversham and Station 28 on Mitchell Creek all had a large total taxa count of 41.


LAKE HURON
OWEN SOUND
THORNBURY
BEAVER RIVER
DRAINAGE BASIN
ST. VINCENT TWP.
COLLINGWOOD TWP.
EUPHRASIA TWP.
ARTEMESIA TWP.
OSPREY TWP.
GEORGIAN BAY
BEAVER
EUGENIA LAKE
TLESBURY
ROCK MILLS
1039 90 77
2400 180 250 8
310 32 12 <4
303 51 78
1200 300 590 4
130 24 28 <4
386 63 71
2000 400 610 8
160 20 12 <4
516 70 71
3400 530 1260 4
130 16 4 <4
626 89 45
5100 470 1300 8
240 40 <4 <4
534 101 25
4000 740 990 <4
30 20 <4 <4
377 73 151
4600 800 1250 <4
60 4 16 <4
748 80 86
1100 310 280 <4
470 28 16 <4
234 80 86
2200 280 500 <4
20 16 8 <4
376 56 34
1300 130 210 <4
160 16 12 <4
560 149 95
4800 530 1250 4
60 24 8 <4
676 137 109
3900 660 1280 4
210 24 8 4
319 68 38
2900 300 410 8
130 8 8 <4
28323 4548 3812
260000 16000 21000 100
2300 140 180 <4
40 12 84 <4*
336 49 67
3500 520 610 <4
20 4 12 <4
270 83 52
2800 510 700 <4
20 8 <4 <4
243 26 170
2000 280 1030 <4
20 <4 8 <4
382 62 92
2200 400 830 <4
90 24 4 44
81 39 44
1300 380 840 4
<10 <4 4 4
94 44 30
480 220 340 <4
410 12 <4 <4
155 49 48
400 200 200 <4
30 12 8 <4
124 23 37
580 290 640 <4
10 8 <4 <4
172 24 35
820 370 710 <4
20 4 4 <4
191 38 66
1700 220 350 4
30 8 4 <4
676 192 95
10100 1500 1500 <4
70 28 16 <4
462 89 42
6100 510 1480 12
30 28 4 <4
231 58 77
6100 660 1500 16
<4 <4 8 <4
72369 1828 1966
90000 4800 6700 100
6300 600 600 <4
361 38 60
3100 440 1500 <4
30 8 <4 <4
747 107 61
2700 550 440 4
80 24 4 <4
282 21 36
1300 300 340 <4
30 4 4 <4
210 32 29
3800 310 420 <4
10 8 <4 <4
83 18 20
2700 360 310 <4
8 <4 <4 <4
221 21 25
800 360 380 <4
80 4 <4 <4
207 66 44
2800 600 480 4
80 24 8 <4
270 67 125
2100 330 380 <4
10 10 8 <4
157 28 16
1400 280 120 <4
30 <4 <4 <4
Example
BACTERIA/100ml
TC FC FS PSa
G.MEAN 707 40 85 1
MAX. 600 40 120 <4
MIN. 310 4 8 <4
geometric mean above guidelines
FIGURE 5
MINISTRY OF THE ENVIRONMENT GUIDELINES
Swimming and Bathing Use of Water
TC = TOTAL COLIFORM should not exceed 1000 per 100 ml
FC = FECAL COLIFORM should not exceed 100 per 100 ml
FS = FECAL STREPTOCOCCI ——— no guidelines
PSa = PSEUDOMONAS aeruginosa ——— should not be present
MINISTRY OF THE ENVIRONMENT
BACTERIOLOGICAL CONCENTRATIONS
AT 38 LOCATIONS ON BEAVER RIVER
May - October 1981
SCALE
DRAWN BY
DATE
CHECKED BY
DRAWING NO.

Of interest is the diversity of the benthic community in the lower end of the river system. Station 4 and 5 downstream from Heathcote and station 6 upstream from Heathcote, produced 40, 39 and 37 taxa respectively. The communities at these stations were well balanced with pollution intolerant organisms, such as dobsonflies, stoneflies, mayflies and caddisflies being well represented. Communities of this type are generally not found in the lower portion of main rivers, but rather in headwater areas or tributaries. They are indicative of clear, well oxygenated flowing streams.

Populations of Ephemeroptera (mayflies) were exceptionally common throughout the entire system. Nine families of mayflies were found with a total of 19 genera being present. Trichoptera (caddisflies) populations were also well distributed throughout the system with an exceptional number of families (13) and genera (29) being present.

These excellent macroinvertebrate communities provide a good food source for fish and other wildlife in the basin.

4.9 Aquatic Vegetation

Growths of pondweed (*Potamogeton spp.*) were common in the Beaver River between Feversham and Lake Eugenia, and also downstream from Kimberly to Heathcote in the main stream.

Growths of the filamentous green algae *Cladophora* (bottom coverage 0 - 20%) were present in most of the fast flowing sections of the system. Stations 18, 21, and 24, all upstream from Feversham, had moderate to heavy

Cladophora growths (60-100% bottom coverage) in cobble rock areas. Cladophora growths were also luxuriant downstream from the dam at Thornbury.

Cladophora is a nuisance aquatic plant which grows profusely in nutrient rich streams and lakes. Nutrient levels (phosphorus) are adequate in some sections of the Beaver River system to allow this nuisance plant to be present in significant quantities. Increases in nutrient levels, water temperature or sunlight from streambank clearing or ditching operations could trigger serious Cladophora growths. Large areas of the Beaver River system have clear flowing streams with cobble rock substrate. Such areas are very prone to luxuriant Cladophora growth. A special effort must be made to protect the Beaver River system from the potential threat of substantial Cladophora production. One only has to look to other streams in Southwestern Ontario to see the impact. Excessive Cladophora growths exist in the Avon River at Stratford, the Bayfield River, the Maitland River and a channelized section of the Lucknow River.

The Cladophora problem occurs when excessive nutrients become available. In the case of the Beaver River, a phosphorus level of greater than .03 mg/l can promote significant Cladophora growths. Phosphorus levels in this type of system under natural (forested) conditions would be normally less than .015 mg/l.

GROUNDWATER RESOURCES

Groundwater is an important resource in the Beaver River Basin as most people rely on it for their water supply. While a few local problems exist, adequate quantities of good quality water are produced by most wells in the area.

Overburden Hydrogeology

Unconsolidated overburden materials in the basin consist of various glacial deposits, primarily poorly-sorted, low permeability tills incapable of yielding adequate supplies of groundwater to wells. Local glacial spillway deposits or ice-contact materials consisting of sands and gravels do supply some shallow wells, however.

Bedrock Hydrogeology

Most wells in the Beaver River Basin tap the bedrock aquifers. Above the Niagara Escarpment, approximately the southern half of the basin is underlain by the Guelph-Amabel Formation. This area has a productive dolomite aquifer capable of supplying adequate good quality groundwater for most purposes. Below the escarpment, bedrock of the Cabot Head, Queenston and Georgian Bay Formations supplies wells with generally less copious quantities of groundwater, but in most cases adequate for domestic use.

Problems

Groundwater problems with respect to quantity, quality and security exist locally in the Beaver River Basin.

Below the Niagara Escarpment, adequate supplies are locally unavailable for some purposes, while most wells do produce sufficient water for domestic supply. In the same area, a few wells intersect groundwater too high in dissolved solids to be considered potable.

In areas where the overburden is very thin or consists of permeable deposits which form a shallow aquifer,

the groundwater is susceptible to contamination from surface sources such as septage, road salt or agricultural runoff. Care must be taken in the location and construction of wells in such areas and in the handling of potential contaminants.

APPENDIX I

Macroinvertebrates collected at 37 sites on the Beaver River and Tributaries, July 1981 (Number per ft. sq.)

	Beaver River													Boyne River				
ORGANISM	1	2	3	4	5	6	7	10	11	12	13	14B	15	16	17	17B	TA	TB
MEGALOPTERA																		
Corydilidae (Dobsonflies)																		
Nigronia		1	P	2	1	1	P	1	1		1		4	P		5		1
Sialidae (Alderflies)																		
Sialis	1	1			1					1								
PLECOPTERA (Stoneflies)																		
Pteronareidae																		
Pteronarcys																	2	
Nemouridae																		
Nemoura Amphinemura												33						
Leuctridae											1		4		1		P	2
Leuctra	P																	
Perlidae												1	1					
Acroneuria		1		1														P
Paragentina		1	1	2	1			P	P	1			1		3	1		P
Phasganophora	1	1		2	1									3				P
Perlesta																		
Perlodidae																	P	
Isoperla																		
Chloroperlidae												2					6	
Alloperla																		
EPHEMEROPTERA (Maylifes)																		
Siphilonuridae																		P
Isonychia	1	P	3	7	1													
Baetidae								4	P	1	1	36	11	1	12	19	119	6
Baetis	1	1	1	6	11	1												
Callibaetis	P													1		2		
Centroptilum							P									P		
Cloeon																		
Pseudocloeon	2	1	1		1													
Heptgeniidae										P			P					P
Epeorus								1	2	7		1	1	1	1	7	P	1
Heptagenia	7	2	1	8	1	1			1				2	P				1
Stenacron	1	1	P		4	1			1	7	4			1		47		
Stenonema	3	2	2	6	2	1		P										

Appendix I. (continued)

ORGANISM	Beaver River 1	2	3	4	5	6	7	Boyne River 10	11	12	13	14B	15	16	17	17B	TA	TB
Tricorythidae																		
Tricorythodes	3	4		1		1			P	P			5	19				
Caenidae																		
Caenis	2	5	1	1	1	4		4	2	44	5		2	1				1
Leptophlebiidae																		
Paraleptophlebia									P	1			9	1	P	16		P
Ephemerellidae																		
Drunnella												4					1	2
Eurylophella			P										P	P				
Serratella		1	2	7	1			10	2	13	9	1	7		16		8	P
Ephemeridae																		
Ephemera										1	1	1						
Polymitarayidae																		
Ephoron	2	8	8	2														
Hexagenia				4														
TRICHOPTERA (Caddisflies)																		
Philopotamidae															1		1	
Chimarra			1	9	6					P				P	42			
Dolophilodes												1	1				P	
Psychomyiidae																		
Psychomyia			1	9	3	1			12		1	1				3		
Polycentropodidae																1		
Neureclipsis				1														
Phylocentropus							1											
Polycentropus	1	1										1	1					1
Hydropsychidae								1										
Cheumatopsyche	2	4	2	20	22	8	P	13	6	14	15	1	1		121	9	1	1
Hydropsyche		10	30	87	31	100		8	12	5	21	1	1	1	185	1	2	
Rhyacophiloidae								P										
Rhyacophila								1			1	1	1		1		6	1
Glossosomatidae																		
Glossosoma								2	P	2	1	1	3				P	

Appendix I. (ontinued)

ORGANISM	Beaver River													Boyne River				
	1	2	3	4	5	6	7	10	11	12	13	14B	15	16	17	17B	TA	TB
Hydroptilidae																		
Hydroptila	2	1																
Ochrotrichia																	3	
Oxyethira															1			
Phyrganeidae																		
Ptilostomis																		
Agrypina																		
Lepidostomatidae																		
Lepidostoma																		
Brachycentridae												3			P		P	P
Micrasema			1															
Limnephilidae													3	1			P	
Hesperophylax																		
Pycnopsyche																		
Goera														1				
Limnephilus																		P
Neophylax																		
Onocosmoecus																3		
Helicopsychidae																		
Helicopsyche					3					1			3	3	2	12		1
Leptoceridae																		
Ceraclea																		
Oecetis				1			1		1	P			P	2				
Trianodes													P					
Mystaeides														P		1		
Nectopsyche	P					1	1			2	4	1	P		13	1		
Unidentified pupae																		
ODONATA																		
ZYGOPTERA (Damselflies)																		
Agrionidae																		
Agrion		P			P	P				P	P			P	P	P		P
Argia				1	P	P	P		P									
Chromagrion						P	P	P										
Ischnura																1		
Unident																		

Appendix I. (continued)

ORGANISM	Beaver River 1	2	3	4	5	6	7	10	11	12	13	14B	Boyne River 15	16	17	17B	TA	TB
ANISOPTERA (Dragonflies)																		
Corculegastridae																		
Cordulegaster										P								P
Gomphidae																		
Haegenius													1		P			
Stylogomphus																		P
Aeshnidae																		
Aeshna																		
Boyeria				P		P				P								
Macromiidae																		
Macromia																		
Libellulidae																		
Leucorrhinia																		
Sympetrum																		
LEPIDOPTERA (Aquatic Capterpillars)																		
Pyralidae																		
Parargyractis				P	4	1												
COLEOPTERA (Bettles)																		
Gyrinidae																		
Gyrinus																		
Haliplidae																		
Haliplus																		
Dytiscidae																		
Deronectes																		
Graphoderus																		
Hydroporus							P											
Hygrotus							P											
Laccophilus										P								
Oreodytes							P											
Thermonectus																		

Appendix I. (continued)

ORGANISM	Beaver River 1	2	3	4	5	6	7	Boyne River 10	11	12	13	14B	15	16	17	17B	TA	TB
Hydrophilidae																		
Hydrobius																		
Psephenidae																		
Ectopria		1	1		P	3						1				1		
Psephenus		1		1	3			1	P	6	2		1	1	1	19		
Elmidae																		
Dubiraphia		P	P		1	P	1	P							P	1		
Macronychus						P				1						P		
Microcylloepus						P												
Optioservus			4		2	3		3	1	5	6	1	4	7	7	1		1
Promoresia	P	1		1				1	1	P		10	1				14	7
Stenelmis	1	3	15	3	21	47	P	1	8	9	3		5	6	18	3	1	
HEMIPTERA (True Bugs)																		
Cicadillidae															P			
Corixidae	P	P	P				P											
Veliidae				1	P	P	P		1	P								
Gerridae						P	P											
HYDRACARINA (Water Mites)	1		1	5			1	15	1		4	1	13	1	18	2	P	3
AMPHIPODA (Scuds)																		
Taltridae																		
Hyalella azteca					P	P	P		P					8	1	P		
Gammaridae																		
Gammarus																		
Crangonyx	1																	
ISOPODA (Sow Bugs)																		
Asellidae																		
Asellus	2																	

Appendix I. (continued)

ORGANISM	Beaver River 1	2	3	4	5	6	7	10	11	12	13	14B	Boyne River 15	16	17	17B	TA	TB
DECAPODA (Cray Fishes)																		
Astacidae																		
Orconectes propinquus			1	P	1	1										1		
Orconectes (immature)	P		P	P		P	P	P			P			P				
Cambarus (immature)																		
PELECYPODA (Clams)																		
Sphaeriidae																		
Pisidium					P			P			P		P			P		P
Sphaerium					P		1						26		P			
Unionidae					P			P										
GASTROPODA (Snails)																		
Ancylidae																		
Ferrissia																		
Planorbidae																		
Gyraulus																		
Helisoma				P														
Lymnaeidae																		
Lymnaea																		
Physidae			P															
Physa	P	P	P	P	3	P		P	P		P		P		1	P		P
Pleuroceridae																		
Goniobasis				P	1	1												
Amnicolidae																		
Amnicola			P	P			2											
DIPTERA (True Flies)																		
Chironomidae																		
Tanypodinae		1		1	P	1	4	1		P	1	1	6	3	3	6	2	1
Chironominae	13	27	3	2	5	11	32	3		7	4	4	16	5	57	3	43	13
Diamesiniae																		
Orthocladiinae	23	27	12	1	1	1	3	9			3		21	1	4	4	16	26
Unidentified pupae										1	1		1	1	1	1	P	
Ceratopogonidae							1			P			1		P		1	P

Appendix I. (continued)

ORGANISM	Beaver River 1	2	3	4	5	6	7	10	11	12	13	Boyne River 14B	15	16	17	17B	TA	TB
Empididae		2		1				P			1				1	1		
Dixidae																		
Dixilla							P											
Rhagionidae																		
Athrix		1	4	1		2												
Ptychopteridae																		
Ptychoptera												P						
Simuliidae																		
Cnephia															1			
Simulium															4	1	P	
Tabanidae																		
Chrysops								P										
Tipulidae																		
Tipula																		
Antocha			1	1	1	4		12		5	76		3	1	3	1		3
Dactylolabis																		
Dicranota												1					9	
Hexatoma					1	1						1	1				P	1
Pseudolimnophila										1								
Pilaria																		
Rhabdomastix											P							
HIRUDINAE (Leeches)																		
Erpobdellidae	3																	
Glossiphoniidae							3											
TURBELLARIA (Flatworms)					1	1							P		32			
OLIGOCHEATA (Worms)																		
Tubificidae	6	2	1	1		1		2							1			
Lumbriculidae										2		18			1		P	P
Total Taxa	29	33	33	40	39	37	27	31	24	36	28	27	41	30	38	37	28	34
Total Numbers	79	115	98	196	136	198	51	83	52	137	149	128	161	70	553	174	235	73

Appendix I. (continued)

ORGANISM	Beaver River													Mitchell Creek and Tributaries					
	14	18	19	20	21	22	22A	23	24	25	25A	TC	TD	8	27	28	29	30	31
MEGALOPTERA																			
Corydilidae (Dobsonflies)																			
Nigronia	P		4	2					1	P	P					1	2	2	1
Sialidae (Alderflies)																			
Sialis	1		1	1		1	P		P	P	P	P				1		1	1
PLECOPTERA (Stoneflies)																			
Pteronareidae																			
Pteronarcys	P																		
Nemouridae																			
Nemoura Amphinemura									1										
Leuctridae																			
Leuctra	7	15	145	34	6	3			18		P	P				1			
Perlidae																			
Acroneuria	2	1							P					1		1		3	2
Paragentina		P			1					P	P					5		P	6
Phasganophora		P		1										2		2		4	1
Perlesta						3													
Perlodidae																			
Isoperla																			
Chloroperlidae																			
Alloperla	2			1															
EPHEMEROPTERA (Maylifes)																			
Siphlonuridae																			
Isonychia		P	2	1										5		4		P	4
Baetidae																			
Baetis	75	25	38	45	11	15	P	5	124	P	P	P		1		45	7	5	3
Callibaetis			P										P		P				
Centroptilum	P							P											
Cloeon																			
Pseudocloeon			2	1					P										
Heptageniidae														1					
Epeorus									1					4		2	3	3	5
Heptagenia	1	P												P			1	P	
Stenacron						1			P		P								
Stenonema		P		1		1				P				1		1	25	1	2

Appendix I. (continued)

ORGANISM	Beaver River													Mitchell Creek and Tributaries					
	14	18	19	20	21	22	22A	23	24	25	25A	TC	TD	8	27	28	29	30	31
Tricorythidae																			
Tricorythodes	1	P	47	30	20	5		1	16	P				P				P	
Caenidae																			
Caenis		P												3		14	1	1	89
Leptophlebiidae																			
Paraleptophlebia	1	3		1	5	2			1	P	P	P		2		1			1
Ephemerellidae																			
Drunnella	1	2	3	1														1	
Eurylophella																			
Serratella	1		125	75		2			29					1		7			1
Ephemeridae				2															
Ephemera																P			3
Polymitarayidae																			
Ephoron																			
Hexagenia				4															
TRICHOPTERA (Caddisflies)																			
Philopotamidae		1	1																
Chimarra			P							P							1	1	1
Dolophilodes			6	2	2				P					1		1		1	1
Psychomyiidae																	2		
Psychomyia						1													
Polycentropodidae																			
Neureclipsis																			
Phylocentropus																		P	
Polycentropus		1	1			1		P			P								
Hydropsychidae			3		1											2	41	29	6
Cheumatopsyche	1	1	1	2	3	1		3						19		4	24	51	42
Hydropsyche	2	1	P	4	50	11		14	1	P									
Rhyacophiloidae																		P	1
Rhyacophila	2	1																	
Glossosomatidae																			
Glossosoma	2	2	1	9	1				2		P			1					1

Appendix I. (continued)

ORGANISM	Beaver River													Mitchell Creek and Tributaries					
	14	18	19	20	21	22	22A	23	24	25	25A	TC	TD	8	27	28	29	30	31
Hydroptilidae																1			
Hydroptila																			
Oschrotrichia					2														
Oxyethira																			
Phyrganeidae				P			P	P			P			P					
Ptilostomis																			
Agrypina			2												P				
Lepidostomatidae	1	P	1	32	P	1	P	1	13	P	P					1			
Lepidostoma																			
Brachycentridae	4								1										
Micrasema																			
Limnephilidae									8							1			
Hesperophylax		1	P		1	4		P	1	P	P								
Pycnopsyche										P	P								
Goera			P				P								P				
Limnephilus				1			P												
Onocosmoecus																			
Helicopsychidae						1													
Helicopsyche		1	1																
Leptoceridae																			
Ceraclea			3																
Oecetis																			
Trianodes																			
Mystaeides											P				P		1	3	
Nectopsyche								1											
Unidentified pupae																			
ODONATA																			
ZYGOPTERA (Damselflies)													P				1	P	P
Agrionidae				1															
Agrion															P				
Argia																			
Chromagrion																			
Ischnura																			

Appendix I. (continued)

ORGANISM	Beaver River 14	18	19	20	21	22	22A	23	24	25	25A	TC	TD	Mitchell Creek and Tributaries 8	27	28	29	30	31
ANISOPTERA (Dragonflies)																			
Cordulegastridae																			
Cordulegaster									1										
Gomphidae																			
Hagenius																			
Aeshnidae																			
Aeshna							P	1											
Boyeria												P	P			1		P	
Macromiidae										P									
Macromia							P					P							
Libellulidae																			
Leucorrhinia										P					P				
Sympetrum																			
LEPIDOPTERA (Aquatic Capterpillars)																			
Pyralidae																			
Parargyraetis																			
COLEOPTERA (Bettles)																			
Gyrinidae																			
Gyrinus												P							
Haliplidae																			
Haliplus					1					P									
Dytiscidae					P														
Deronectes					1		P												
Graphoderus																			
Hydroporus																			
Hygrotus																			
Laccophilus																			
Oreodytes																			
Thermonectus		P																	

Appendix I. (continued)

ORGANISM	Beaver River													Mitchell Creek and Tributaries					
	14	18	19	20	21	22	22A	23	24	25	25A	TC	TD	8	27	28	29	30	31
Hydrophilidae																			
Hydrobius				P						P									
Psephenidae																			
Ectopria		3								P									
Psephenus																1	2		
Elmidae														1		5		1	6
Dubiraphia										P			P						
Macronychus																			
Microcylloepus																			
Optioservus	1	2	7	11	2			7	1							4	2	4	1
Promoresia	2	20	3	1	1				3							16			
Stenelmis									1					1		2		9	7
HEMIPTERA (True Bugs)																			
Cicadillidae																			
Corixidae				P			P	1		P									
Veliidae								1					P			1			1
Gerridae				P				1	1	P	P	P							
HYDRACARINA (Water Mites)	6		3	6	9			4	6	P			P			14	4		4
AMPHIPODA (Scuds)																			
Taltridae																			
Hyalella azteca			P	2	34		P		1	P	P	P	P		P	1	1		
Gammaridae																			
Gammarus					4		P								P				
Crangonyx									P										
ISOPODA (Sow Bugs)																			
Asellidae																			
Asellus								48							P	1			

Appendix I. (continued)

ORGANISM	Beaver River													Mitchell Creek and Tributaries					
	14	18	19	20	21	22	22A	23	24	25	25A	TC	TD	8	27	28	29	30	31
DECAPODA (Cray Fishes)																			
Astacidae																			
Orconectes propinquus									P										
Orconectes (immature)																P	P		
Cambarus (immature)																			
Adult										P					P			P	P
PELECYPODA (Clams)																			
Sphaeriidae																			
Pisidium			P	P	1		P	P	1	P	P				P		1		
Sphaerium													P		P				
Unionidae																			
GASTROPODA (Snails)																			
Ancylidae																			
Ferrissia																P	4		
Planorbidae																			
Gyraulus			1		1		P										3		
Helisoma				P	1							P	P				1		
Lymnaeidae																			
Lymnaea			P	P						P			P						
Physidae																			
Physa	P	P	2	1	15		P	2	P			P	P	P	P	P	P	P	
Pleuroceridae																			
Goniobasis																			
Viviparidae																			
Campeloma																			
Amnicolidae																			
Amnicola																			
DIPTERA (True Flies)																			
Chironomidae																			
Tanypodinae	2	6	6	1	3		P	1	19	P	P	P	P	2	P	2			2
Chironominae	14	4	56	6	44		P	9	41	P	P	P	P	2	P	11	25	9	12
Diamesini																			
Orthocladiinae	2	2	47	39	35		P	20	48	P	P	P		1		50	4	1	1
Ceratopogonidae	1				P		P	1			P		P						

Appendix I. (continued)

ORGANISM	Beaver River													Mitchell Creek and Tributaries					
	14	18	19	20	21	22	22A	23	24	25	25A	TC	TD	8	27	28	29	30	31
Empididae	1	1					P		1										
Dixidae																			
Dixilla																			
Rhagionidae																			
Athrix			8	1	8											21		2	
Ptychopteridae																			
Ptychoptera												P							
Simulidae																			
Cnephia																			
Simulium	3	P	P		1			1	P		P	P							
Tabanidae																			
Chrysops		P	P		1		P					P	P				P		
Tipulidae																			
Tipula																			P
Antocha	1	1	8	2				1								4	8	32	8
Dactylolabis																P			P
Dicranota									1		P					1			
Hexatoma		P							1	P	P								
Pseudolimnophila																			
Pilaria		P							1										
Rhabdomastix									P										
Unident. Pupae									1					1			3	P	1
HIRUDINAE (Leeches)																			
Eropobdellidae		P						1		P						1			
Glossiphoniidae		1			1			P					P		P		1		
																	1		
TURBELLARIA (Flatworms)											P			P					
OLIGOCHEATA (Worms)																			
Tubificidae			P	P	3		P						P	1	P		8	27	13
Lumbriculidae	1	1			3			1	2		P				P				
Total Taxa	31	40	40	37	34	16	22	28	41	29	27	18	18	24	18	41	30	33	33
Total Numbers	138	102	527	316	270	53	--	124	347	--	--	--	--	52	--	234	177	191	145

APPENDIX II

Station Averages.

Water Quality Data for the Beaver River -- May to November 1981

Station	Bacteria/100ml			Phosphorus		Nitrogens				pH	$CaCO_3$	Ca	Mg	Calc Hard	Susp. Solids	Bact.	Pseudomonas	Turb.	Cl	COND in units per cm 25°C
	Total Coliform	Fecal Coliform	Fecal Strep	Total	Sol	F.A.	Kjel.	Nitrate	Nitrite											
1	1039	90	77	.028	.002	.021	0.39	.004	0.28	8.26	204	51.8	21.8	219	13.2	5060	5	9.4	5.3	368
2	303	51	78	.022	.003	.015	0.35	.003	0.29	8.27	204	53.6	21.7	224	9.4	5171	4	6.9	5.0	364
3	386	63	71	.025	.003	.027	0.37	.003	0.22	8.27	204	51.3	22.9	223	10.5	4511	5	8.4	5.0	365
4	516	70	71	.022	.002	.025	0.38	.003	0.24	8.18	201	50.8	22.5	222	8.9	4912	4	6.4	5.2	368
5	626	85	45	.021	.003	.025	0.39	.004	0.28	8.17	202	51.8	21.8	219	7.4	4311	5	4.5	5.3	369
6	678	192	95	.031	.002	.035	0.51	.044	0.16	7.92	241	69.7	19.3	254	9.3	4206	4	5.6	8.7	625
7	462	89	42	.025	.002	.034	0.46	.003	0.25	8.07	208	52.0	22.0	221	7.8	6177	5	4.9	7.75	412
8	231	58	77	.020	.002	.005	0.32	.002	0.19	8.91	214	56.4	20.8	227	17.2	5188	6	11.8	2.8	396
10	361	38	60	.013	.003	.009	0.32	.002	0.62	8.36	208	51.4	23.3	224	4.9	4006	4	2.3	6.5	407
11	747	107	61	.020	.003	.011	0.36	.002	0.36	8.34	215	55.6	22.1	230	6.9	6823	4	6.2	3.3	431
12	282	21	38	.010	.001	.008	0.31	.002	0.60	8.36	210	51.3	23.7	226	4.7	2611	4	1.7	6.8	447
13	220	32	29	.013	.001	.014	0.32	.002	0.50	8.35	209	50.4	23.7	224	3.5	1473	4	1.3	6.7	447
14	83	18	20	.006	.002	.005	0.18	.001	0.91	8.24	240	60.6	24.0	259	2.6	4366	4	1.22	9.5	470
14B	221	21	25	.010	.003	.005	0.24	.001	0.76	8.34	241	61.6	25.2	258	4.0	1963	4	1.5	10.0	470
15	207	66	44	.013	.002	.011	0.25	.002	0.40	8.30	223	56.4	24.0	240	4.2	3925	4	0.98	15.5	469
16	270	67	125	.016	.001	.014	0.35	.003	0.23	8.18	214	53.6	23.1	229	6.3	5661	4	1.51	12.8	447
17	157	28	16	.014	.001	.032	0.36	.002	0.13	8.13	207	52.0	22.7	224	4.0	2186	4	1.5	11.7	433
17B	191	38	66	.013	.001	.013	0.42	.002	0.12	8.17	185	46.0	20.0	198	4.1	3419	4	1.2	4.7	352
18	270	83	52	.021	.010	.008	0.33	.003	1.34	8.15	244	66.8	22.8	261	4.4	3087	4	0.60	2.5	419
19	91	44	30	.016	.006	.009	0.31	.002	1.10	8.18	247	62.6	25.0	267	3.8	1977	4	0.70	4.0	466
20	81	35	44	.022	.008	.009	0.31	.003	1.39	8.26	242	64.1	24.0	259	3.7	2265	4	0.48	4.5	441
21	676	137	109	.032	.012	.063	0.45	.009	1.40	7.98	244	67.5	22.7	262	4.5	4416	4	0.45	2.8	426
22	560	149	95	.011	.003	.012	0.31	.002	1.47	7.96	241	70.3	21.2	263	4.0	4781	4	0.52	3.8	419
22A	376	56	34	.011	.004	.010	0.30	.001	1.46	7.99	257	67.8	25.6	275	4.7	3185	4	0.23	2.0	460
23	349	68	38	.004	.001	.016	0.25	.005	0.78	7.91	243	69.8	21.2	262	3.6	3652	5	0.25	2.3	428
24	362	82	92	.043	.024	.006	0.35	.002	1.01	8.10	235	63.8	23.8	257	5.2	3281	4	0.62	3.8	431
25	336	49	67	169	.117	.007	0.58	.001	0.24	8.01	230	61.5	23.0	248	8.9	4065	4	1.90	4.0	412
25A	40	12	84	.046	.038	.005	0.32	.001	0.28	7.94	233	67.0	23.6	265	1.9	4000	4		5.0	
26	35323	4048	3612	10.86	5.6	8.0	18.94	.156	0.46	7.58	321	73.4	27.2	296	71.2	1,991,81	15	46.4	27.0	1330
27	234	80	66	.025	.011	.019	0.36	.002	0.08	7.90	214	54.5	22.1	228	4.6	4021	4	0.92	1.3	393
28	748	80	86	.030	.004	.007	0.42	.001	0.08	8.37	207	51.2	21.7	217	12.0	3981	4.0	4.80	2.0	371
29	12,369	1625	1986	.033	.004	.032	0.56	.007	0.43	8.35	168	48.7	15.1	184	9.0	17,310	12	5.20	5.0	362
30	317	73	151	.015	.002	.011	0.35	.003	0.60	8.40	220	62.5	19.5	237	7.8	9211	4	3.50	5.2	414
31	534	101	25	.028	.002	.007	0.39	.002	0.21	8.42	212	54.9	20.5	222	13.4	4550	4	8.20	2.8	388
Tributary A	129	23	37	.011	.002	.005	0.29	.001	1.19	8.32	256	66.8	26.5	276	9.6	1461	4	0.98	6.8	467
Tributary B	172	24	35	.017	.002	.005	0.30	.001	0.19	8.86	238	60.0	26.2	254	12.1	1970	4	1.30	10.3	443
Tributary C	155	45	48	.009	.003	.007	0.30	.002	1.28	8.02	236	55.8	30.8	286	3.7	2314	4	0.37	10.0	466
Tributary D	243	36	170	.007	.001	.015	0.38	.006	1.38	8.04	251	63.8	19.4	271	3.8	5630	4	0.48	2.7	443

Station Number 03-0036-009-02

Monthly Monitoring of the Beaver River -- Grey County Rd. 30, South of Kimberly -- 1981

Date	BOD5	Bacteria/100ml			Phosphorus		Nitrogens				Cond.	Turb	Chloride	P.S.A.	pH	Solids			Pren	Si	SO_4	Alk	Acid.	Na	K	Ca	Mg	Fe	Color	Hard.
		Total Coliform	Fecal Coliform	Fecal Strep	Total	Sol	F.A.	Kjel.	Nitrite	Nitrate						Total	Susp.	Diss												
Jan. 6	1.3	210	<4	<4	.008	.002	.035	0.30	.004	1.17	468	0 40	6.0	<4	8.02	266.1	3.4	262.7	—	2.18	11.5	238	19 4	2.9	1.25	61.0	25.2	0.03	15	256
Feb 3	0.4	10[A]	<4	<4	.008	.001	.050	0.35	.007	1.31	497	0 95	5.5	<4	8.09	265 4	8.8	256.6	41.0	2.76	12.5	255	25.6	2.9	1.05	64.0	25.8	0.05	11	266
Mar 2	0.4	676	4	<4	.011	.002	.015	0.21	.004	1.37	429	1.50	6.5	<4	8.10	248.4	5.2	243.2	—	2 36	11.0	207	9.7	3 1	1.45	65.0	20 4	0.10	14	222
Apr 7	0.5	4	<4	8	.004	.001	.005	0.19	.003	1.12	438	0.60	5.5	<4	8.28	258 4	3.3	255.1	41.0	1.66	11.0	220	3.9	2.9	1.00	66.5	23 4	0.09	12	238
May 6	1.0	136[C]	<4	<4	.009	.001	.006	0.28	.003	0.85	417	0.60	5.0	<4	8.34	239.3	6.1	233.2	41.0	0.72	11.0	219	0	2.8	1.05	55.5	23.0	0.06	15	234
June 2	1.3	270	8	<4	.007	.002	.020	0.30	.004	0.57	412	0.85	5.5	<4	8.41	237.0	1.9	235.1	41.0	0 66	11 0	212	0	3.2	0.95	52.0	23.6	0.09	10	227
July 8	1.3	170[C]	28	12	.012	.001	.010	0.36	.004	0.26	368	2.10	5.0	<4	8.55	212 8	4.4	233.7	41.0	—	9.5	188	0	3.0	0.85	42 0	23.4	0.07	17	201
Aug 4	0.5	230[C]	32	112	.008	.001	.005	0 42	.002	0.75	456	0.95	8.0	<4	8.35	304.4	2.5	302.1	41.0	2.86	13.0	234	0	4.8	1.15	58.0	25.4	0.06	14	252
Sept 15	0.6	360	20	4	.011	<.001	.035	0.36	.002	0.22	364	0.35	5.5	<4	8.35	211 6	2.2	236.6*	4.0	2.24	8.0	188	0	2.8	0.95	39.0	22.4	0.05	14	190
Oct 6	0.8	820[C]	276	560	.023	.001	.025	0.43	.002	0.39	387	4 40	5.0	<4	8 42	246.4	11.1	251.6*	4 0	2 22	10.0	196	0	3 2	1.35	47 0	23 2	0.42	15	213
Nov 3	1.3	40[A]	4	<10	.006	.001	.005	0 31	.003	0 40	398	0 50	5.0	<4	8 35	230 8	0 9	260 0*	41.0	1.60	9.0	204	0	2.8	1.00	49.0	23 6	0.05	10	—
Dec 8	1.1	20	<4	8	.008	<.001	.005	0 25	.002	0.74	427	0 55	6.0	<4	8 34	243 6	1 8	241.8	41.0	—	10.0	222	0	3 1	1.00	56.0	23.8	0.05	14	238
Mean	0.9				.010	.001	.017	0.31	.003	0.76	421	1.10	5.7	<4	8.3	247.0	4.3	242.7	41.0	1.93	10.6	215	4.9	3.1	1.09	49.5	23.6	.009	13	231

A -- approximate count, too few colonies
C -- approximate count, total count greater than 300 colonies
* -- calculated

Station Number 03-0036-005-02

Monthly Monitoring of the Beaver River -- 1st Bridge downstream Hwy 10, Flesherton -- 1981

Date	BOD_5 (mg/l)	Bacteria/100ml			Phosphorus		Nitrogens				Cond.	Turb.	Chlorides	P.S.A.	pH	Solids		
		Total Coliform	Fecal Coliform	Fecal Strep.	Total	Sol.	F.A.	Kjel.	Nitrite	Nitrate						Total	Susp.	Diss.
Feb 3	0.3	380	60	8	0.018	0.003	0.015	0.32	0.005	0.66	498	7.9	14.0	<4	8.12	330.7	31.6	299.1
Mar 2	0.7	150	<10	20[A]	0.014	0.004	0.015	0.28	0.004	0.48	373	1.5	10.0	<4	8.13	235.5	6.8	228.7
Apr 7	—	88	20	8	0.012	0.003	0.005	0.26	0.003	0.43	440	1.0	11.5	<4	8.31	269.7	4.3	265.4
May 6	0.5	236[C]	8	4	0.010	0.001	0.005	0.20	0.002	0.47	459	0.6	14.5	<4	8.31	276.6	3.9	272.7
June 5	1.0	700[C]	12	4	0.011	0.002	0.005	0.27	0.002	0.36	462	0.8	16.0	<4	8.48	262.2	3.8	258.4
July 8	0.4	420[C]	72	36	0.007	0.003	0.005	0.22	0.001	0.18	476	3.4	10.5	32	8.40	283.6	5.4	277.7
Aug 4	0.2	220	16	20	0.012	0.005	0.015	0.21	0.002	0.07	487	0.6	10.5	<4	8.33	296.8	2.5	294.3
Sept 15	0.4	280	4	64	0.009	0.003	0.005	0.26	0.001	0.31	436	0.6	11.5	<4	8.44	259.6	3.0	256.6
Oct 6	0.8	2900	360	428	0.022	0.003	<0.005	0.38	0.002	0.39	446	2.2	14.5	<4	8.21	278.4	9.1	269.3
Nov 3	1.0	210	8	4	0.009	0.002	<0.005	0.28	0.001	0.37	458	0.6	12.0	<4	8.30	270.0	1.3	268.7
Dec 8	1.4	80	<4	16	0.012	0.001	0.010	0.33	0.002	0.42	453	0.7	14.5	<4	8.29	265.8	1.8	264.0
Mean	0.67				.012	.003	.008	0.27	.002	0.38	453	1.8	12.7	6.45	8.30	275.4	6.7	623.7

A -- approximate count, too few colonies
C -- approximate count, total count greater than 300 colonies

Station Number 03-0036-007-02

Monthly Monitoring of the Beaver River -- Conc. 10, Osprey Twp, 1.6 Kilometres N. of Feversham - 1981

Date	BOD_5 (mg/l)	Bacteria/100ml			Phosphorus		Nitrogens				Cond.	Turb.	Chlorides	P.S.A.	pH	Solids		
		Total Coliform	Fecal Coliform	Fecal Strep.	Total	Sol.	F.A.	Kjel.	Nitrite	Nitrate						Total	Susp.	Diss
Mar 2	0.3	40[A]	<4	<4	0.011	0.003	<0.005	0.25	0.004	2.1	480	8.00	2.0	<4	8.03	292.4	14.4	278.0
Apr 7	0.2	4	<4	<4	0.005	0.003	0.005	0.24	0.004	1.68	460	0.35	2.0	<4	8.18	282.6	3.2	279.4
May 6	0.3	204	24	4	0.020	0.007	0.010	0.24	0.009	1.61	466	0.45	1.5	<4	8.03	277.4	4.3	273.1
June 2	0.7	330	36	24	0.019	0.009	0.005	0.24	0.006	1.41	474	0.48	2.0	<4	8.17	272.6	3.5	269.1
July 8	0.5	240[C]	88	56	0.025	0.012	0.005	0.38	0.003	1.03	449	0.65	2.5	<4	8.15	300.7	3.1	297.6
Aug 4	0.5	350[C]	144	136	0.022	0.009	0.010	0.28	0.001	1.06	460	0.80	2.0	<4	8.16	291.0	10.4	280.6
Sept 15	0.4	260	32	12	0.011	0.009	0.005	0.23	0.001	1.31	491	0.20	2.5	<4	8.22	274.1	1.3	272.8
Oct 6	0.7	530[C]	58	236	0.010	0.003	<0.005	0.29	0.001	1.39	454	0.35	2.5	<4	8.10	284.2	1.8	282.4
Nov 3	0.9	40[A]	<4	<4	0.008	0.006	0.055	0.20	0.001	<0.01	500	0.65	2.5	<4	8.14	291.4	2.8	288.6
Dec 8	0.8	4	12	16	0.008	0.004	0.005	0.21	0.004	1.90	487	0.30	2.5	<4	8.17	273.0	1.2	271.8

A -- approximate count, too few colonies
C -- approximate count, total count greater than 300 colonies

Station Number 03-0036-008-02

Monthly Monitoring of the Beaver River -- Conc. 8, Osprey Twp. .8 Kilometres SE of Feversham - 1981

Date	BOD_5 (mg/l)	Bacteria/100ml			Phosphorus		Nitrogens				Cond.	Turb.	Chlorides	P.S.A.	pH	Solids		
		Total Coliforms	Fecal Coliform	Fecal. Strep.	Total	Sol.	F.A.	Kjel.	Nitrite	Nitrate						Total	Susp.	Diss
Mar 2	0.6	90[A]	10[A]	40[A]	0.037	0.018	<0.005	0.38	0.002	1.26	434	1.5	3.5	<4	7.99	263.1	9.7	253.4
Apr 7	0.6	4	20	4	0.023	0.013	0.005	0.33	0.002	0.63	410	0.60	3.0	<4	8.06	254.4	4.6	249.8
May 6	0.3	180	56	12	0.041	0.021	0.005	0.34	0.005	1.26	467	0.45	4.0	<4	7.98	272.9	4.9	268.0
June 2	0.9	250	<4	24	0.038	0.027	0.005	0.32	0.002	0.99	471	0.38	4.0	<4	8.20	281.2	3.3	277.9
July 8	0.5	490[C]	236	84	0.067	0.046	0.005	0.47	0.003	1.29	471	0.80	4.5	<4	8.10	285.4	6.2	279.2
Aug 4	1.5	2400	>600	192	0.102	0.026	0.030	0.71	0.002	1.40	474	1.7	4.5	<4	8.04	306.8	13.5	293.3
Sept 15	0.3	300	4	20	0.046	0.041	<0.005	0.30	0.001	1.12	480	0.25	4.5	<4	8.19	288.0	1.7	286.3
Oct 6	0.5	1300[C]	208	>600	0.028	0.018	<0.005	0.39	0.003	0.83	437	0.55	3.5	<4	8.08	286.2	4.4	281.8
Nov 3	0.7	30[A]	4	<10	0.010	0.007	0.005	0.21	0.001	1.12	478	0.25	4.5	<4	8.14	278.7	0.8	277.9
Dec 8	1.4	44	28	4	0.011	0.006	0.005	0.26	0.001	1.11	459	0.30	4.5	<4	8.10	258.9	1.5	257.4
	0.9				0.040	0.022										277.6	5.1	272.5

A -- approximate count, too few colonies
C -- approximate count, total count greater than 300 colonies

Station Number 03-0036-006-02

Monthly Monitoring of the Beaver River -- Grey County Rd. 2, Feversham -- 1981

Date	BOD_5 (mg/l)	Bacteria/100ml			Phosphorus		Nitrogens				Cond.	Turb.	Chlorides	P.S.A.	pH	Solids		
		Total Coliforms	Fecal Coliforms	Fecal Strep.	Total	Sol.	F.A.	Kjel.	Nitrite	Nitrate						Total	Susp.	Diss
Mar 2	0.3	50[A]	48	4	0.012	0.009	<0.005	0.34	0.002	1.91	458	7.80	3.0	<4	8.10	293.2	15.2	278.0
Apr 7	0.4	408[C]	4	<4	0.015	0.007	0.005	0.42	0.002	1.32	440	0.65	3.0	<4	8.12	274.2	6.5	267.7
May 6	0.5	168	16	48	0.030	0.013	0.010	0.27	0.005	1.50	468	0.75	3.0	<4	8.09	272.0	7.1	264.9
June 2	0.8	230	24	28	0.035	0.013	0.005	0.44	0.003	1.24	477	0.35	3.5	<4	8.20	279.2	2.4	276.8
July 7	0.7	250[C]	144	60	0.043	0.027	0.020	0.41	0.005	1.08	454	0.65	3.5	<4	8.21	276.8	2.9	273.9
Aug 4	0.5	410[C]	136	68	0.016	0.004	0.005	0.28	0.002	1.06	463	0.75	2.5	<4	8.19	308.2	4.1	304.1
Sept 15	0.4	620	28	24	0.024	0.018	0.010	0.29	0.002	1.26	476	0.40	3.5	<4	8.25	285.8	2.3	283.5
Oct 6	0.6	1030[C]	216	>600	0.020	0.010	0.005	0.34	0.001	1.33	470	2.20	3.5	<4	8.17	290.4	8.1	292.3
Nov 3	0.8	60[A]	8	<10	0.009	0.005	0.005	0.23	0.001	1.56	492	0.40	4.0	<4	8.18	292.4	1.7	290.7
Dec 8	1.1	12	4	<4	0.008	0.003	<0.005	0.24	0.001	1.65	475	0.50	4.0	<4	8.19	270.6	1.8	268.8
					0.021	0.011										284.3	5.2	279.1

A -- approximate count, too few colonies

C -- approximate count, total count greater than 300 colonies

Station Number 03-0036-002-02

Monthly Monitoring of the Beaver River -- at R.R. Bridge, Thornbury -- 1981

Date	BOD_5 (mg/l)	Bacteria/100ml			Phosphorus		Nitrogens				Cond.	Turb.	Chlorides	P.S.A.	pH	Solids		
		Total Coliform	Fecal Coliform	Fecal Strep.	Total	Sol.	F.A.	Kjel.	Nitrite	Nitrate						Total	Susp.	Diss
Jan 6	2.0	172	12	<4	0.014	0.003	0.010	0.31	0.004	0.95	487	1.5	6.0	<4	7.86	282.2	8.8	273.4
Feb 3	0.7	30[A]	8	52	0.016	0.007	0.015	0.34	0.005	0.92	510	2.5	6.5	<4	7.99	311.0	7.4	308.6
Mar 2	0.3	110	4	<4	0.016	0.003	0.005	0.23	0.004	0.83	404	4.2	5.5	<4	8.15	250.4	9.7	240.7
Apr 6	—	270	28	4	0.011	0.001	0.005	0.27	0.003	0.42	400	3.4	4.5	<4	8.24	246.2	6.7	239.5
May 5	1.0	192[C]	16	16	0.020	0.001	0.015	0.33	0.004	0.64	425	3.7	4.5	<4	8.12	251.9	10.4	241.5
June 2	1.4	360	64	12	0.021	0.001	0.015	0.32	0.003	0.34	418	3.8	5.0	<4	8.38	242.4	8.2	234.2
July 7	1.0	180[C]	60	20	0.088	0.004	0.035	0.80	0.004	0.13	386	9.7	5.0	<4	8.34	263.9	18.1	250.9[*]
Aug 4	0.7	350[C]	52	36	0.038	0.010	0.025	0.46	0.006	0.21	413	12.0	6.5	<4	8.30	289.3	18.3	271.0
Sept 15	0.8	620[C]	140	76	0.029	0.001	0.010	0.42	0.002	0.11	402	6.8	5.5	<4	8.34	252.1	16.3	235.8
Oct 6	0.8	2800	228	484	0.027	0.001	<0.005	0.39	0.001	0.22	407	6.2	5.0	<4	8.31	268.6	17.2	251.4
Nov 3	1.3	190[C]	56	10[A]	0.014	0.002	0.005	0.31	0.002	0.35	429	3.8	6.5	<4	8.26	256.0	6.9	249.1
Dec 8	1.3	124	32	20	0.013	0.002	<0.005	0.26	0.001	0.64	442	3.5	6.0	<4	8.23	253.8	6.1	247.7
					0.021	0.003										263.2	11.2	252.0

A -- approximate count, too few colonies

BEAVER RIVER SAMPLING

August 24, 1982

Station	Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Phosphorus as P		pH	Iron as Fe	Chloride as Cl	Susp Solids	Turbidity	Calcium as Ca	Magnesium as Mg	Calculated Hardness	Alka as
					Total	Diss Reactive									
Feversham Pond	0.005	0.25	0.003	0.76	0.011	0.004	8.09	0.04	2.0	1.6	0.50	73.0	23.0	277	2
18	0.005	0.22	0.001	0.93	0.018	0.008	8.20	0.04	2.5	5.2	1.05	71.5	23.0	274	2
24	0.010	0.28	0.001	1.37	0.013	0.007	8.27	0.02	4.5	2.8	0.51	67.5	25.4	273	2
25	0.005	0.27	0.001	0.22	0.083	0.079	7.96	0.05	3.5	1.9	0.42	69.5	25.2	278	2
25A	0.005	0.26	0.001	0.32	0.069	0.061	7.95	0.05	3.5	2.5	0.52	70.5	25.8	283	2

BEAVER RIVER SAMPLING

August 25, 1982

Station	Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Phosphorus as P Total	Phosphorus as P Diss Reactive	pH	Iron as Fe	Chloride as Cl	Susp Solids	Turbidity	Calcium as Ca	Magnesium as Mg	Calculated Hardness	Alkalin as CaC
Beaver River #1	0.025	0.38	0.004	0.19	0.025	0.002	8.34	0.67	6.7	17.5	11.7	48.0	21.4	208	199
3	0.015	0.35	0.003	0.21	0.013	0.001	8.37	0.34	7.0	9.9	5.9	50.0	21.6	214	201
5	0.015	0.33	0.003	0.22	0.012	0.002	8.37	0.22	7.0	5.1	3.3	51.5	22.2	220	206
6	0.025	0.43	0.004	0.30	0.035	0.004	8.30	0.82	7.0	21.8	14.6	56.5	22.6	234	218
8	0.010	0.62	0.004	0.12	0.077	0.007	8.49	2.26	3.5	54.4	46.0	53.0	19.2	212	202
10	0.005	0.46	0.002	0.46	0.033	0.001	8.38	0.67	8.5	23.1	14.1	55.0	21.2	225	214
11	0.005	0.52	0.002	0.21	0.046	0.004	8.43	1.00	7.5	27.5	18.0	62.0	21.2	242	228
13	0.005	0.54	0.002	0.32	0.037	L0.001	8.34	0.68	8.0	23.6	16.0	50.0	20.2	221	208
14B	L0.005	0.42	0.002	0.56	0.021	0.001	8.35	0.24	8.0	12.3	6.4	59.5	20.6	234	222
15	0.005	0.36	0.002	0.31	0.039	0.003	8.33	0.28	13.5	7.7	4.3	55.0	20.2	221	20[illegible]
18	0.005	0.32	0.001	0.85	0.019	0.009	8.14	0.05	2.5	5.1	1.09	66.5	20.4	250	22[illegible]
19	0.005	0.29	0.002	1.06	0.014	0.004	8.22	0.07	4.0	3.8	1.39	65.0	23.2	258	23[illegible]

BEAVER RIVER SAMPLING

August 25, 1982

Station	Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Phosphorus as P		pH	Iron as Fe	Chloride as Cl	Susp Solids	Turbidity	Calcium as Ca	Magnesium as Mg	Calculated Hardness	Alkali as Ca
					Total	Diss Reactive									
25	0.005	0.39	0.001	0.04	0.095	0.079	7.85	0.11	3.0	2.7	1.26	68.0	19.4	250	20
25A	0.010	0.46	0.002	0.05	0.046	0.017	7.80	0.24	2.5	6.8	2.1	54.5	19.8	218	19
29	0.045	0.92	0.019	0.48	0.107	0.035	8.21	1.88	11.0	31.8	37.0	66.0	15.6	229	19
Tributary A	L0.005	0.49	0.001	0.65	0.024	0.001	8.36	0.26	7.5	16.1	6.3	59.5	21.6	238	22
Tributary B	L0.005	0.53	0.001	0.03	0.020	L0.001	8.28	0.54	9.5	19.8	9.6	56.5	21.0	228	21
Tributary C	0.010	0.46	0.003	0.64	0.015	0.001	7.91	0.10	13.5	4.1	1.84	55.0	21.6	226	20